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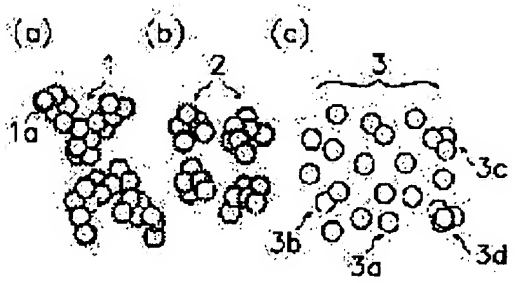
(71)Applicant : MURATA MFG CO LTD

(72)Inventor : SASAKI TSUTOMU
WATANABE SHINYA
TOMITA TETSUYA

(54) PULVERIZING METHOD FOR ELECTRICAL CONDUCTIVE POWDER, AND ELECTRICAL CONDUCTIVE COATING USING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an electrical conductive powder having excellent dispersibility and its pulverizing method and further to provide an electrical conductive powder capable of exhibiting excellent surface roughness and electric properties and high reliability in the case that it is used for electrodes of ceramic electronic parts, its pulverizing method, and an electrical conductive coating using the electrical conductive powder.



SOLUTION: The pulverizing method for an electrical conductive powder comprises preparing an electrical conductive powder composed of agglomerates 1 of metal particles that the average particle size of primary particles is regulated to ≤1.0 μm, pulverizing the electrical conductive powder to primary particles 30 or agglomerates 3b close to the primary particles, and recovering the resultant pulverized electrical conductive powder. Further, the method includes a step of forcing the fine projections existing at respective surfaces of the primary particles of the pulverized electrical conductive powder or the agglomerates close to the primary particles, into respective inner parts of the particles and rounding them.

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CLAIMS

[Claim(s)]
[Claim 1] The grinding approach of the conductive powder characterized by having the process for which the conductive powder with which the mean particle diameter of a primary particle contains the floc of metal particles 1.0 micrometers or less is prepared, the process which grinds said conductive powder even to the floc a primary particle or near the primary particle, and the process which collects said conductive powder which carried out grinding processing.
[Claim 2] The grinding approach of said conductive powder is the grinding approach of the conductive powder according to claim 1 characterized by having the process which is [part / very small / which exists in the primary particle of said ground conductive powder, or the floc front face near the primary particle / projection] crowded in slight push roundness inside a particle.
[Claim 3] The grinding approach of said conductive powder is the grinding approach of the conductive powder according to claim 1 or 2 characterized by collecting conductive powder with approximately spherical.
[Claim 4] Conductive powder obtained by the grinding approach given in any [claim 1 thru/or] of 3 they are.
[Claim 5] Said conductive powder is conductive powder according to claim 4 characterized by consisting of one or more sorts chosen from Ag, Cu, nickel, and Pd.
[Claim 6] The conductive paint characterized by consisting of conductive fines, a solvent, and a binder according to claim 4 or 5.

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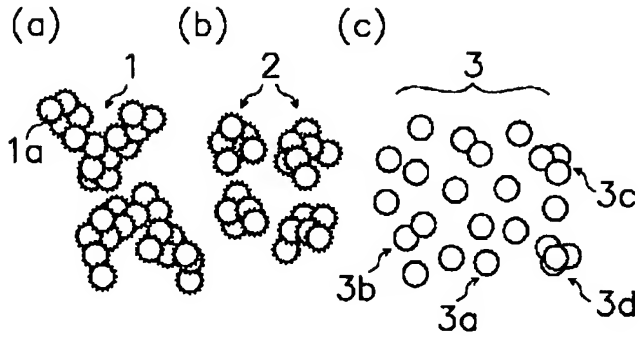
Drawing selection Representative drawing



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Such a conductive paint is used about the manufacture approach of conductive powder that this invention is used as a conductive paint, as very small ceramic electronic parts, especially an internal electrode of a stacked type ceramic condenser.
[0002]
[Description of the Prior Art] A conductive paint is conventionally used as an electrode of ceramic electronic parts. Such a conductive paint consists of for example, conductive powder, a solvent, and a vehicle. As for conductive powder, particle size consists of Ag, Cu, nickel, Pd, etc. (about tennm thru/or several micrometers).
[0003] First, such a conductive paint kneads conductive powder, a solvent, and a vehicle by the kneader, a mixer, etc., distributes conductive powder and is obtained by 3 rolls, the ball mill using media, the sand mill, etc. The front face of a conductive paint of the electrode with which it fully distributes, and conductive powder carries out spreading printing, and is obtained in the coating is smooth, and it is required that the packing nature of the metal contained in an electrode should be high. When it uses that the distribution in the coating of conductive powder is inadequate, for example as an internal electrode of a stacked type ceramic condenser, faults, such as a fall of electrostatic capacity and an increment in variation and equivalent series resistance, arise.
[0004] The fact that conductive powder takes condensation structure is cited as a cause it becomes inadequate distributing in the coating of conductive powder, and the inclination becomes remarkable, so that conductive powder is fines. Therefore, after pulverizing the condensation structure of conductive powder, you need to make it distribute in a vehicle, in producing a conductive paint using conductive powder with a fine particle size.
[0005] Moreover, in order to attain 2 micrometer order of coating thickness of a conductive paint with small-and-light-izing of the electronic parts in recent years, the mean particle diameter of a primary particle needs to offer conductive powder 1 micrometer or less.
[0006]
[Problem(s) to be Solved by the Invention] However, according to the above-mentioned conventional technique, when the mean particle diameter of the primary particle of conductive powder is 1 micrometer or less, or when condensation of conductive powder is firm, condensation structure cannot fully be pulverized, but there is a trouble it becomes inadequate distributing in the coating of conductive powder.
[0007] Moreover, by the ball mill or the sand mill, since there is ductility in the metal used as conductive powder when grinding processing is performed, conductive powder carries out flat [of the conductive powder] by the collision of media, and it becomes scale-like. When the conductive paint which consists of conductive powder of the shape of such a scale is used for formation of the internal electrode of ceramic electronic parts, the major axis of conductive scale-like powder exceeds the thickness of an internal electrode, it becomes causes, such as a fall of the smooth nature of an electrode

surface, and an electric short circuit between the internal electrodes by which the laminating was carried out, and there is a trouble of having a bad influence on the dependability of ceramic electronic parts.
[0008] Moreover, the front face of the conductive powder generally compounded by the wet reduction method has parts for many lobe in the shape of konpeito. Since the conductive powder which has a part for such a lobe has low tap density, when it uses for formation of the internal electrode of ceramic electronic parts as a conductive paint, it has the trouble that the packing nature of the conductive powder in a paint film and the smooth nature of an electrode surface fall.
[0009] The purpose of this invention is to offer the conductive paint using the conductive powder which can demonstrate the surface roughness which was excellent when it was made that an above-mentioned trouble should be canceled, and the conductive powder excellent in dispersibility and its grinding approach were offered and it used as an electrode of ceramic electronic parts, the outstanding electrical property, and high dependability, its grinding approach, and this conductive powder.
[0010]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, in the grinding approach of the conductive powder of this invention, it is characterized by having the process for which the conductive powder with which the mean particle diameter of a primary particle contains the floc of metal particles 1.0 micrometers or less is prepared, the process which grinds said conductive powder even to the floc a primary particle or near the primary particle, and the process which collects said conductive powder which carried out grinding processing. Moreover, as for the grinding approach of said conductive powder, it is desirable to have the process which is [part / very small / which exists in the primary particle of said ground conductive powder or the floc front face near the primary particle / projection] crowded in slight push roundness inside a particle.
[0011] Moreover, as for the grinding approach of said conductive powder, it is desirable to collect conductive powder with approximately spherical.
[0012]
[Embodiment of the Invention] One operation gestalt by this invention is explained based on drawing 1 and drawing 2 . The conductive powder before grinding processing contains many flocs 1 which much primary particle 1a combined as shown in drawing 1 (a). If the conductive powder before such grinding is fed into grinding equipment and grinding processing is performed, it will be decomposed to the floc 2 smaller than those [two or more], and floc 1 will be ground soon to the flocs 3b, 3c, and 3d much primary particle 3a or near the primary particle.
[0013] As shown in drawing 2 (a), as for primary particle 3a which constitutes the conductive powder of this invention, mean particle diameter L1 says a primary particle 1.0 micrometers or less. Moreover, in the flocs 3b, 3c, and 3d near [which constitutes the conductive powder of this invention] the primary particle, as shown in drawing 2 (b), (c), and (d), the floc to which it becomes from 2 thru/or four primary particle 3a, and the Flocs [3b 3c, and 3d] major axes L2, L3, and L4 do not exceed the twice of the mean particle diameter L1 of primary particle 3a is said. That is, floc 3b near the primary particle consists of two primary particle 3a, and the major axis L2 says the floc which does not exceed the twice of the mean particle diameter L1 of primary particle 3a. Similarly, floc 3c near the primary particle consists of three primary particle 3a, and the major axis L3 says the floc which does not exceed the twice of the mean particle diameter L1 of primary particle 3a. Similarly, floc 3c near the primary particle consists of four primary particle 3a, and the major axis L4 says the floc which does not exceed the twice of the mean particle diameter L1 of primary particle 3a. Therefore, the particle size of the conductive powder obtained by the grinding approach of this invention is within the limits of less than 2.0 micrometers.
[0014] On the occasion of grinding processing of the conductive powder of this invention, the jet mill of a revolution air-current method was used. This is explained based on drawing 3 . a jet mill 11 is shown in drawing 3 (a) and (b) -- as -- mainly -- the fine-particles supply nozzle 12, the body 13 of equipment, and the blow-of-gas nozzle 14 -- since -- it becomes. the body 13 of equipment -- a pulverization chamber 15, casing 16, the classification plate 17, the classification room 18, the coarse powder return opening 19, and the fines exhaust port 20 -- since -- it becomes.

[0015] The fine-particles supply nozzle 12 is tubing which supplies the conductive powder before grinding to the body 13 of equipment, and the end section is connected to the peripheral wall of the body 13 of equipment.
[0016] The body 13 of equipment consists of a container of an abbreviation hemisphere, and the end section of the fine-particles supply nozzle 12 and the end section of two or more blow-of-gas nozzles 14 are connected to the peripheral wall, respectively.
[0017] The blow-of-gas nozzles 14 are two or more tubing which supplies high pressure gas to the interior of the body 13 of equipment, the end section of each nozzle is connected to the peripheral wall of the body 13 of equipment, and the other end is connected to high pressure gas supply equipment (not shown). The blow-of-gas nozzle 14 is altogether connected spirally towards the same revolution direction as a revolution air current so that a revolution air current may occur in the pulverization chamber 15 and the classification room 18 within the body 13 of equipment with the high pressure gas supplied from this blow-of-gas nozzle 14.
[0018] A pulverization chamber 15 is located in the body of equipment 13 interior, and points out the field surrounded by the fine-particles supply nozzle 12 and the blow-of-gas nozzle 14 centering on the classification plate 17.
[0019] Casing 16 is in the body of equipment 13 interior, it is located in the upper part of the fine-particles supply nozzle 12, the blow-of-gas nozzle 14, and a pulverization chamber 15, and the shape of an anchor ring which equipped the center section with the hole is made. The radius of casing 16 hole is shorter than the radius of a pulverization chamber 15, and the role of the diaphragm with which a pulverization chamber 15 and the classification room 18 are divided is played.
[0020] The classification plate 17 is in the body of equipment 13 interior, it is located on the axial center of a pulverization chamber 15, and nothing, the classification room 18, and the fines exhaust port 20 are divided for the structure which equipped the cylindrical upper part section with the swelling.
[0021] The classification room 18 is located in the body of equipment 13 interior, is located in the casing 16 upper part, and points out the field surrounded with body of equipment 13 outer wall, casing 16, and the classification plate 17.
[0022] The coarse powder return opening 19 is opening which is in the body of equipment 13 interior, was located in the part by which the blow-of-gas nozzle 14 is connected to body of equipment 13 peripheral wall, and was prepared in each blow-of-gas nozzle 14.
[0023] The fines exhaust port 20 is located in the body of equipment 13 interior, it is located in the upper part of the classification plate 17, tubed structure is made, and the end section stands in a row from the classification room 18.
[0024] Next, the grinding approach of conductive powder is explained based on drawing 3 (a) thru/or drawing 3 (c). First, high pressure gas G1 is supplied to coincidence, and the revolution air current G2 of the fixed direction arises from two or more blow-of-gas nozzles 14 attached in the peripheral wall of the body 13 of equipment in a pulverization chamber 15.
[0025] Next, the conductive powder before the grinding processing supplied to the fine-particles supply nozzle 12 is sent into a pulverization chamber 15 by gas G3 for fine-particles supply which flows the inside of the fine-particles supply nozzle 12, and conductive powder is supplied into the revolution air current G2 of a pulverization chamber 15. And according to the centrifugal force which this revolution air current G2 produces, conductive powder collides mutually, or it collides with the wall of a pulverization chamber 15, and grinding of condensation structure is performed.
[0026] Next, in order for mass to fall compared with floc, the influence of the centrifugal force which a revolution air current produces declines, and the conductive powder which it was fully ground and was atomized goes up to the upper part of casing 16 with an assembly near the axial center of a pulverization chamber 15 gradually, and flows into the classification room 18 with the classification plate 17 soon formed on the axial center of a pulverization chamber 15.
[0027] Next, the conductive powder which flowed into the classification room 18 is classified by coarse powder and fines by the difference in mass. That is, coarse powder reaches the coarse powder return opening 19 in accordance with the air current G4 which passes through the outside of casing 16 from the

classification room 18, flows in the blow-of-gas nozzle 14, by the high pressure gas G1 which flows the inside of a blow-of-gas nozzle, is returned to a pulverization chamber 15 and is again supplied into the revolution air current G2. Fines are sent to the fines exhaust port 20 in accordance with the air current G5 which goes up further, and are collected in the G6 direction.

[0028] In addition, generally, when the jet mill of a revolution air-current method grinds conductive powder, conditions, such as a pressure of high pressure gas, an input of conductive powder, and a count of grinding, are controlled according to the physical properties of the conductive powder to throw in and the property for which the conductive powder after grinding is asked, i.e., the property of the conductive paint for which it asks.

[0029] For example, in grinding processing of this invention, the effectiveness which pulverizes the condensation structure of conductive powder becomes large, so that the gas pressure of the high pressure gas supplied from the blow-of-gas nozzle 14 is high. However, if it raises too much superfluously exceeding 1 constant pressure, conductive powder will corn again, floc will be formed and particle size distribution and paint film surface roughness will fall.

[0030] Moreover, if a powder feed rate is raised, since the conductive powder concentration of the grinding indoor section will increase and the probability of collision of conductive powder will become high, the effectiveness which pulverizes condensation structure becomes large. However, the variation in the electrostatic capacity of the surface roughness of the paint film which printed the conductive paint which powder is discharged from a fines exhaust port before grinding [of a jet mill] indoor powder concentration when a powder feed rate is raised too much becomes high too much, and not being ground or fully being classified, particle size distribution and tap density are inferior in such conductivity powder, and consists of such conductivity powder, and was formed, and the produced stacked type ceramic condenser is inferior similarly.

[0031] In the art of the conductive powder of this invention, the conductive powder which consists of a primary particle of 2.0 micrometers or less within the limits or floc near the primary particle can be obtained by controlling above-mentioned terms and conditions.

[0032] According to grinding processing of the conductive powder of this invention, the amount of [which exists in a flocs / primary particle 3a of conductive powder thru/or near the primary particle / 3b, 3c, and 3d / front face] lobe decreases efficiently. This is explained based on drawing 4 and drawing 5 .

[0033] The conductive powder before grinding processing consists of much flocs 1, as shown in drawing 1 , much primary particle 1a which projects as shown in drawing 4 , and has partial 1b condenses this floc 1, and it is constituted. Although lobe part 1b mainly consists of a particle, this presentation, or its oxide, since the mean particle diameter of primary particle 1a of the conductive powder which performs grinding processing by this invention is 1.0 micrometers or less and the minimum, lobe part 1b is a particle and this presentation, and has metallic ductility.

[0034] If such conductive powder is used for the grinding approach of this invention, the floc 1 contained in conductive powder will be supplied into the revolution air current G2 which flows the inside of the pulverization chamber 15 of the body of equipment 13 interior, as shown in drawing 5 , and grinding processing will be performed by the grinding-impulse force which collides with the collision of powder, or the wall of the body 13 of equipment. Lobe part 1b which exists in coincidence on the front face of the conductive powder 3 by collision is crowded in slight push roundness inside a particle, and the flocs 3b, 3c, and 3d of the near approximately spherical primary particle 3a and near the primary particle as shown in drawing 2 (a) thru/or (d) are obtained.

[0035] The conductive paint of this invention consists of conductive powder, a solvent, and a vehicle. Conductive powder consists of metal powder which carried out grinding processing by the grinding approach of this invention. Although especially a solvent is not limited, carbitol, terpineol, etc. which are used for the conductive paint, for example from the former can be used suitably. Although especially a vehicle is not limited, cellulose system resin, such as the methyl cellulose and ethyl cellulose which are used for the former or a conductive paint, for example, and a nitrocellulose, acrylic resin, an alkyd resin, phenol system resin, etc. can be used suitably.

[0036]

[Example] First, the mean particle diameter of the primary particle compounded by the wet reduction method as conductive powder prepared the nickel metal powder which is 0.6 micrometers, and made this the conductive powder of the example of a comparison.
[0037] Next, about the above-mentioned nickel metal powder, powder feed rates are 10 kg/h, squeezing pneumatic pressure is 6kg/cm2 conditions, and 1, 2, 3, and the thing carried out 5 or 10 times were used as an example 1 thru/or the conductive powder of 5 for grinding processing using the jet mill of a revolution air-current method, respectively. In addition, the jet mill used that whose bore of a pulverization chamber is 100mm.
[0038] Next, the powder feed rate used as the conductive powder of examples 6 and 7 that to which 10 kg/h and squeezing pneumatic pressure carried out grinding processing twice on conditions (2kg/cm2 and 7kg/cm2), respectively, using the jet mill of a revolution air-current method in the above-mentioned nickel metal powder, respectively.
[0039] Next, what squeezing pneumatic pressure used 6kg/cm2 on condition that 3 kg/h and 13 kg/h, and the powder feed rate used the jet mill of a revolution air-current method for the above-mentioned nickel metal powder, respectively, and carried out grinding processing twice was used as the conductive powder of examples 8 and 9, respectively. Then, particle size distribution (D50, D90) and tap density were measured about the conductive powder of an example 1 thru/or 9, and the example of a comparison, and this was summarized in Table 1.
[0040] Next, the organic vehicle 40 weight section which mixed beforehand the alpha terpineol 36 weight section and the ethyl cellulose 4 weight section, and the alpha terpineol 10 weight section were added to the conductive powder 50 weight section of an example 1 thru/or 9, and the example of a comparison, after kneading by the mixer, 3 rolls were used and it distributed, and the conductive paint of an example 1 thru/or 9, and the example of a comparison was obtained, respectively. Then, the conductive paint of an example 1 thru/or 9, and the example of a comparison was printed on the glass plate, the paint film was formed, each paint film surface roughness was measured with the contact process surface roughness plan, and this was summarized in Table 1.
[0041] Next, the stacked type ceramic condenser with which electrostatic capacity is set to 1 micro F was produced using the conductive paint of an example 1 thru/or 9, and the example of a comparison. That is, the reducibility-proof ceramic green sheet of the JIS-B weighting was prepared first, and 70 layers were accumulated with the ceramic green sheet which forms the internal electrode which prints said conductive paste and serves as 2.0 micrometers of coating thickness, and does not form the internal electrode on the ceramic green sheet of the number of predetermined leaves, and it was stuck by pressure with the press machine, it cut into 3.2mmx1.6mm size in the dicer, and the ceramic layered product of an example 1 thru/or 9, and the example of a comparison was obtained, respectively. Next, debinding processing was performed in nitrogen-gas-atmosphere mind, the ceramic layered product was calcinated in the weak reducing atmosphere, the ceramic baking object was formed, the conductive paste which uses silver as a principal component was baked on the both ends of the die-length direction of this ceramic baking object, the external electrode was formed, and the stacked type ceramic condenser of an example 1 thru/or 9, and the example of a comparison was obtained, respectively. Then, the electrostatic-capacity variation of the stacked type ceramic condenser of an example 1 thru/or 9, and the example of a comparison was measured, and this was summarized in Table 1.
[0042]
[Table 1]

試	粉砕条件			導電性粉末			塗布膜	積層セラミックコンデンサ
	圧搾空気圧	粉砕回数	粉末供給速度	粒度分布		タップ密度	塗膜表面粗さ	静電容量バラツキ
料	(kg/cm^2)	(回)	(Kg/h)	D_{50}(μm)	D_{90}(μm)	(g/cm^3)	(μm)	3CV (%)
比較例	-	-	-	45.0	83.0	3.5	3.5	11.8
実施例1	6	1	10	0.8	1.3	1.6	1.6	3.9
実施例2	6	2	10	0.6	0.9	1.4	1.4	3.5
実施例3	6	3	10	0.6	0.9	1.4	1.4	3.5
実施例4	6	5	10	0.8	1.3	1.7	1.7	4.2
実施例5	6	10	10	1.0	2.0	2.2	2.2	4.7
実施例6	2	2	10	0.8	1.2	1.7	1.7	4.3
実施例7	7	2	10	0.6	0.9	1.5	1.5	3.6
実施例8	6	2	3	1.1	2.1	1.7	1.7	3.8
実施例9	6	2	13	1.2	2.2	1.9	1.9	4.0

[0043] An example 1 thru/or 9 brought a result which is excellent about the surface roughness of the paint film which printed and formed the particle size distribution (D50, D90) of conductive powder and tap density, and a conductive paint and the electrostatic-capacity variation of the produced stacked type ceramic condenser, and all compared with the example of a comparison so that clearly from Table 1.
[0044] Moreover, they brought a result in which particle size distribution, tap density, paint film surface roughness, and electrostatic-capacity variation are excellent, so that the examples 1, 2, and 3 which made the count of grinding 1 and 2 or 3 times had many counts of grinding. On the other hand, the examples 4 and 5 which made the count of grinding 5 or 10 times brought a result to which all are inferior in particle size distribution, tap density, paint film surface roughness, and electrostatic-capacity variation as compared with examples 1, 2, and 3. Therefore, in grinding processing of the conductive powder of this invention, the count of grinding has 1 thru/or 3 desirable times.
[0045] Moreover, squeezing pneumatic pressure brought a result in which particle size distribution, tap density, paint film surface roughness, electrostatic-capacity variation, and the example 2 that made squeezing pneumatic pressure 6kg/cm2 about all are excellent, when the examples 2 and 6 which carried out grinding processing on 6kg/cm 2 or 2kg/cm2 conditions were compared, respectively. However, as compared with the example 2, particle size distribution and tap density are abbreviation EQCs, and the example 7 which made squeezing pneumatic pressure still higher and carried out grinding processing on 7kg/cm2 conditions resulted in it being inferior about paint film surface roughness and electrostatic-capacity variation. Therefore, as for squeezing pneumatic pressure, in grinding processing of the conductive powder of this invention, it is desirable that it is 6kg/cm2 or less.
[0046] Thus, the difference in the grinding condition of conductive powder based on the difference in squeezing pneumatic pressure is clear also from an electron microscope photograph. That is, the electron microscope photograph of the conductive powder of the example of a comparison and examples 2, 6, and 7 is shown in drawing 6 - drawing 9 , respectively.
[0047] The conductive powder of the example of a comparison shown in drawing 6 (a) has parts for many lobe on the surface of the primary particle. On the other hand, the amount of [above-mentioned] lobe decreases by grinding processing, and the conductive powder of the example 2 shown in drawing 7 (a) is changing to approximately spherical, and understands things.
[0048] Moreover, since the conductive powder of the example 6 shown in drawing 8 (a) is carrying out grinding processing, condensation structure is cracked compared with the example of a comparison of drawing 6 (a), but since squeezing pneumatic pressure is as low as 2kg/cm2 as compared with the example 2 shown in drawing 7 (a), the amount of [on the front face of a primary particle] lobe is seldom decreasing.
[0049] Moreover, since the conductive powder of the example 7 shown in drawing 9 (a) is carrying out grinding processing with the squeezing pneumatic pressure of 7kg/cm2 higher than the example 2 shown in drawing 7 (a), the amount of [on the front face of a primary particle] lobe decreases further, and it is changing to approximately spherical. However, it turns out that the primary particle ground

once corns again and forms floc.
[0050] Moreover, as shown in drawing 7 (b), drawing 8 (b), and drawing 9 (b), when the conductive powder of examples 2, 6, and 7 is observed on the whole under a microscope, it projects in addition to the floc a primary particle or near the primary particle, and the removal powder of a part does not exist. Therefore, it projects and it turns out [which decreased] that **** removal of the part was not carried out by the collision of a particle, but it was [the thing] crowded in slight push roundness inside the particle. That is, since the amount of lobe was not nickel oxide but nickel metal of the same presentation as a particle, it became approximately spherical, without metallic ductility's having acted and being removed by the collision of a particle.
[0051] Next, when the examples 2 and 8 which carried out grinding processing for the powder feed rate on condition that 10kg [h] /and 3 kg/h were compared, a result in which particle size distribution, tap density, paint film surface roughness, electrostatic-capacity variation, and the example 2 that made the powder feed rate 10 kg/h about all are excellent was brought. However, the example 9 which gathered the powder feed rate further and carried out grinding processing on condition that 13 kg/h resulted in it being conversely inferior as compared with an example 2 about particle size distribution, tap density, paint film surface roughness, electrostatic-capacity variation, and all. Therefore, as for a powder feed rate, in grinding processing of the conductive powder of this invention, it is desirable that they are 10 or less kg/h.
[0052] In addition, although especially the conductive powder used for the grinding approach of this invention is not limited, the metal powder which consists of Ag, Cu, nickel and Pd which are generally used, for example to a conductive paint, or an alloy containing these one or more sorts can be used.
[0053] Moreover, as a means to prevent the re-granulation of conductive powder, distributed assistants, such as saturated fatty acid, and other re-condensation inhibitors are prepared, and grinding processing may be carried out, after mixing to the conductive powder before grinding.
[0054]
[Effect of the Invention] The process for which the conductive powder with which the mean particle diameter of a primary particle consists of floc of metal particles 1.0 micrometers or less is prepared according to the grinding approach of the conductive powder by this invention as stated above, By having the process which grinds said conductive powder even to the floc a primary particle or near the primary particle, and the process which collects said conductive powder which carried out grinding processing The conductive powder which can demonstrate the surface roughness which was excellent when the dispersibility which was excellent when it used for a conductive paint was used as an electrode of ceramic electronic parts again, an electrical property, and dependability is obtained.
[0055] Moreover, it is the grinding approach of said conductive powder being equipped with the process which is [part / very small / which exists in the primary particle of said ground conductive powder, or the floc front face near the primary particle / projection] crowded in slight push roundness inside a particle, and collecting conductive powder with approximately spherical. When particle size distribution and tap density improve and it uses for formation of the internal electrode of ceramic electronic parts as a conductive paint, the conductive powder by which the packing nature of the conductive powder in a paint film and the smooth nature of an electrode surface are stabilized is obtained.
[0056] Moreover, the grinding approach of said conductive powder is characterized by collecting conductive powder with approximately spherical, and the conductive powder particle size distribution and whose tap density improve further is obtained.
[0057] Moreover, it is characterized by said conductive powder consisting of one or more sorts chosen from Ag, Cu, nickel, and Pd, and the suitable conductive powder for the conductive paint for electrode formation of ceramic electronic parts is obtained.

[Translation done.]